

REMARKS

Claims 1, 3-5, and 8-9 are pending. By the Office Action, claims 1, 3-5, 8, and 9 are rejected under 35 U.S.C. §102, and claims 2, 6, and 7 are rejected under 35 U.S.C. §103. By this Amendment, claim 1 is amended, and claims 2, 6, and 7 are canceled. Support for the amendments to claim 1 can be found, for example, in the specification as filed at page 6, lines 5-16, and the Examples. No new matter is added.

I. Rejection Under 35 U.S.C. §102

Claims 1, 3-5, 8, and 9 are rejected under 35 U.S.C. §102(e) over Komiya. Applicants respectfully traverse this rejection.

Without conceding the propriety of the rejection, claim 1 is amended to incorporate species within the scope of non-rejected claim 2. Accordingly, the rejection is overcome.

Reconsideration and withdrawal of the rejection are respectfully requested.

II. Rejections Under 35 U.S.C. §103

Claims 2, 6, and 7 are rejected under 35 U.S.C. §103(a) as having been obvious over Komiya. Applicants respectfully traverse this rejection with respect to amended claim 1.

Independent claim 1 is directed to an electrolyte material for a fuel cell having a proton conductive system at least comprising (a) a Brönsted acid and (b) a base having a lone electron-pair, wherein the Brönsted acid (a) is selected from the group consisting of methanesulfonic acid, ethanesulfonic acid, benzenesulfonic acid, trifluoromethanesulfonic acid, p-toluenesulfonic acid, and derivatives thereof, and the base (b) has a structure in which one or more groups are added to a group having the lone electron-pair, and a total number of constitutional atoms other than H atom included in all the added group is three or less. Such an electrolyte material would not have been obvious over the cited reference.

The Office Action cites Komiya as disclosing an electrolyte material comprising phosphoric acid or sulfuric acid, and a base. The Office Action also cites Komiya as disclosing the use of perfluorosulfonic acid, although not in combination with a base. The Office Action then argues that it would have been obvious to substitute perfluorosulfonic acid for the disclosed phosphoric acid or sulfuric acid, for use in combination with the base. Applicants disagree.

Although Komiya may disclose the asserted points, those disclosures are variously in the context of the prior art, which does not provide desired results. For example, Komiya discloses in paragraphs [0012]-[0013] the prior art to Schechter et al., wherein phosphoric acid is combined with 1-methylimidazole. However, the Schechter report cited in Komiya specifically indicates that "the addition of 1-methylimidazole to polybenzimidazole and phosphoric acid *does not contribute to* the improvement in proton conductivity." (Emphasis added.) Likewise, Komiya discloses in paragraph [0009] the prior art to Yang et al., in which imidazole is added to Nafion (a perfluorosulfonic acid polymer membrane). The combination is described as providing a proton conductivity of 0.08 to 0.09 S/cm at 160°C in a dry state.

Despite its disclosures, Komiya does not disclose, or teach or suggest, the claimed invention. Komiya does not teach or suggest, or give any reason or rationale to provide, an electrolyte material for a fuel cell having a proton conductive system at least comprising (a) a Brönsted acid selected from the group consisting of methanesulfonic acid, ethanesulfonic acid, benzenesulfonic acid, trifluoromethanesulfonic acid, p-toluenesulfonic acid, and derivatives thereof, and (b) a base having a lone electron-pair, as claimed. There is no indication in the art or elsewhere that Komiya's prior art teachings should or even could be modified to provide an electrolyte material satisfying all of the present claim limitations.

Furthermore, the instant claims are patentable based on the unexpected results provided by the claimed invention. In this regard, the specification contains a number of Examples and Comparative Examples demonstrating unexpected results of the claimed invention, comprising (a) a sulfonic acid Brönsted acid and (b) a recited base having a lone electron-pair and a structure in which one or more groups are added to a group having the lone electron-pair, and a total number of constitutional atoms other than H atom included in all the added group is three or less. These results are compared to otherwise similar compositions using the same sulfonic acid Brönsted acid but that differ in using either a base to which no group is added (e.g., imidazole or pyridine) or a base in which a large number of groups are added (e.g., benzimidazole). Examples 1, 2, 3, and 4 in the specification provide the following results:

Table for Example 1 Conductivities (S/cm) of mixtures at each temperature

Mixture	Temperature		
	20°	80°	120°
Pyridine + methanesulfonic acid	ND	ND	3×10^{-4}
2-(2-hydroxyethyl)pyridine + methanesulfonic acid	0.007	0.027	0.052

Table 1 Conductivities (S/cm) of mixtures at each temperature

Mixture	Temperature		
	20°	80°	120°
imidazole + methanesulfonic acid	ND	2×10^{-6}	6×10^{-6}
2-methylimidazole + methanesulfonic acid	0.006	0.027	0.050
benzimidazole + methanesulfonic acid	ND	ND	1×10^{-6}

Table 2 Conductivities (S/cm) of mixtures at each temperature

Mixture	Temperature		
	20°	80°	120°
imidazole + ethanesulfonic acid	ND	ND	1×10^{-6}
2-methylimidazole + ethanesulfonic acid	3×10^{-6}	0.008	0.021

Table 3 Conductivities (S/cm) of the mixtures at each temperature

Mixture	Temperature		
	20°	80°	120°
imidazole + p-toluenesulfonic acid	ND	ND	1×10^{-5}
1-methylimidazole + p-toluenesulfonic acid	ND	0.003	0.009
2-methylimidazole + p-toluenesulfonic acid	2×10^{-5}	4×10^{-4}	0.008
benzimidazole + p-toluenesulfonic acid	ND	ND	ND

See, specification at pages 14, 15, 16, and 17.

As these results show, the combination of (a) a sulfonic acid Brönsted acid as specified in claim 1, and (b) a recited base having a lone electron-pair and a structure in which one or more groups are added to a group having the lone electron-pair, and a total number of constitutional atoms other than H atom included in all the added group is three or less, provides a conductivity that is as much as 8,000 times higher than the same composition but with either a base to which no group is added or a base in which a large number of groups are added. Nowhere does Komiya suggest that such improved results could or would be obtained by the combination of features of claim 1.

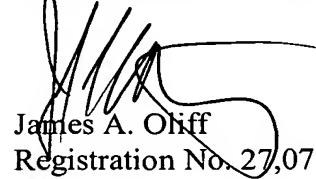
Accordingly, the claims are patentable over Komiya. Reconsideration and withdrawal of the rejection are respectfully requested.

III. Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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Date: June 12, 2009

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